University of Central Florida
School of Electrical Engineering and Computer Science
EGN-3420 - Engineering Analysis.
Fall 2009 - dcm

Project 3 due Thursday week 12 (100 points)

This project covers statistical characterization and linear regression. The material required for this project can be found in Chapters 14 and 15 of the textbook.

Task 1 (40 points). Consider a discrete random variable X with probability density function $p_X(x)$. Define the following quantities: (1) mean; (2) median; (3) mode; (4) range; (5) standard deviation; (6) variance; (7) coefficient of variation. Assume now that X is a continuous random variable; provide the expressions for quantities (1)-(7).

Consider the following set of data:

28.65	26.55	26.65	27.65	27.35	28.35	26.85
28.65	29.65	27.85	27.05	28.25	28.85	26.75
27.65	28.45	28.65	28.45	31.65	26.35	27.75
29.25	27.65	28.65	27.65	28.55	27.65	27.25

Sort the data, place it in 10 bins, and plot the histogram of the data.

Use Matlab functions to compute the : (1) sample mean; (2) sample median; (3) mode; (4) range; (5) sample standard deviation; (6) sample variance; (7) sample coefficient of variation.

Construct a Matlab function to report the quantities (1)-(7) given a vector of data. Test the function using the data in the table.

Task 2 (30 points). Write and test a Matlab function implementing linear regression; the function should also report the standard error of the estimate and plot the predicted values minus the the sample ones function of the argument. Test your function using the data in the Table 13.1 on page 285 of the textbook.

Task 3 (30 points). Two examples of nonlinear models are the *power equation*:

$$y = \alpha e^{\beta x}$$

and the *saturation-growth rate equation*:

$$y = \gamma \frac{x}{\delta + x}.$$

Write a Matlab function to fit a power model; the function should return the best-fit parameters α and β as well as r^2 the coefficient of determination (see page 298 for the definition of r^2) for the untransformed model. Test the function using the following data:

x	y
400	270
70	82
45	50
2	4.8
0.3	1.45
0.16	0.97

Write a Matlab function to fit a saturation-growth rate model; the function should return the best-fit parameters γ and δ. Test the function using the same data. Discuss the results.